126

TUNABLE DIODE PUMPED DYE LASER TREATMENT OF PORT WINE STAINS

Suzanne L. Kilmer, Vera Chotzen, Arielle Kauvar, Adelle Quintana. Laser & Skin Surgery Center of Northern California, Sacramento, CA.

Vascular lesions are best treated by a laser with wavelength that is well absorbed by hemoglobin and penetrates deep enough to reach the targeted vessels. In addition, the optimal pulse duration should match the thermal relaxation time of the targeted vessels. A new diode pumped dye laser tunable for both wavelengths between 585 and 605 nm and pulse widths between 1 to 50 ms will be utilized to treat 20 patients with port wine stains. Optimal wavelengths and pulse widths will be determined by treating at multiple wavelengths and pulse durations in a grid fashion. Successful treatment of port wine stains have been shown with the pulse dye laser at similar treatment parameters but with shorter pulse widths than optimal. In addition, longer pulse widths have been utilized with the Versapulse laser but with a shorter wavelength of 532 nm which does not penetrate as deeply and has more interference by the absorber melanin. We anticipate that this new device which allows tunability for individual patients will offer superior results. This abstract will be further updated to provide treatment results prior to the camera-ready deadline.

127*

USE OF THE DIODE-PUMPED SOLID STATE 532nm LASER FOR THE TREATMENT OF FACIAL TELANGIECTASIAS.

Jenifer Lloyd The Lloyd Dermatology Center Youngstown, Ohio.

PURPOSE: This study was designed to evaluate the safety and efficacy of the Diode-Pumped Solid State (DPSS) 532nm laser (Cynosure, Inc, Chelmsford, MA) for the treatment of unwanted facial blood vessels.

METHODS: Fifteen consenting patients with unwanted facial telangiectasias were enrolled in the study. Pretreatment photographs were obtained and patients were seen for follow up at 1, 4 and 8 weeks. Patients were then given a single treatment with the DPSS 532 nm laser. With the delivered power held constant at 1.9 W, two pulse durations, 30 and 60 ms, were investigated. This resulted in pulse energies of 60 and 120mJ, respectively, focused to a spot size of 0.3 mm. The pulses were delivered at a pulse rate of 3 Hz. The results were categorized by the percentage of vessel clearing: poor (0-25%); fair (26-50%); good (51-75%) and excellent (76-100%).

RESULTS: All lesions treated with the DPSS laser were improved following a single treatment. Greater improvement was noted in the patients treated with the longer, 60ms, pulse duration. There was no evidence of purpura or scarring noted.

CONCLUSION: The results demonstrate that the Cynosure DPSS 532nm laser is a safe and effective modality for the treatment of unwanted facial blood vessels.

128

COMPARISON OF THE DIODE (532NM) AND PULSED DYE (585NM) LASERS IN THE TREATMENT OF FACIAL TELANGIECTASIAS.

Shang I Brian Jiang, Vicki J. Levine, Robin Ashinoff
NYU Medical Center, Ronald O. Perelman Dept of Dermatology, New York, NY

The pulsed dye (585nm) laser has been shown to be effective in the therapy of facial telangiectasias, but its side effect profile and associated pain can prevent some patients from undergoing treatment. The purpose of this investigation is to compare the effectiveness and tolerability of Diode (532nm) and pulsed dye (585nm) lasers in the treatment of facial telangiectasias.

Five patients with facial telangiectasias were treated with Diode and pulsed dye lasers to one half of the facial lesions. Photographic and clinical evaluations of the telangiectasias were performed pre- and postoperatively. Patient's subjective assessment of the associated pain was also obtained.

The Diode and pulsed dye lasers showed similar effectiveness in achieving vessel clearance. The Diode (532nm) laser was associated with decreased intra-operative pain and a shorter recovery period. There was no scarring or permanent pigmentary changes associated with either laser.

The Diode (532nm) laser is an effective treatment option for facial telangiectasias. It may be preferred by patients because of the absence of postoperative purpura, its shorter recovery period, and the decreased procedure associated pain. For the physician, the Diode laser is more cost effective since it is smaller and easily transportable between different locations. In addition, the Diode does not require any warm up time and can potentially be utilized to treat leg veins as well as some pigmented lesions.

GASTROENTEROLOGY/ GENERAL SURGERY/ GYNECOLOGY

132

THORACOSCOPIC APPLICATION OF ND:YAG 1064 NM IN CONGENITAL CYSTIC LUNG DISEASE

D. Cholewa, A.Kischkel, K. Hoffmann, J. Waldschmidt

University Clinic Benjamin Franklin, Dept. of Pediatric Surgery, FU Berlin, Hindenburgdamm 30, 12200 Berlin, Germany

Purpose: Congenital lobar overinflation (CLO), congenital cystic adenomatoid malformation (CCAM) and bronchogenic cysts (BC) are lesions that present as abnormal cystic areas in early life. Is it mandatory to treat this anomalies with endoscopic surgery?

Patients and methods: Between 1992 and 1998, 20 children underwent thoracoscopic treatment of congenital cystic lung disease. We used a Nd:YAG laser 1064 nm with 600 µm bare fiber. The fiber was inserted by 14 Gauge needle. Tissue was severed using the Fibertom mode with 20-30 W in continuous wave and contact mode. Hemostasis, closure of bronchial fistula and sealing of the incision surface was done in the noncontact irradiation with 35 W, an exposure of 0.3-0.5 seconds and an interval duration of 0.5 seconds.

Results: Biopsy specimen were taken successfully in all patients. Intraoperativ complication were observed in 1 case. A bronchial vessel had to be ligated by an endoloop. Revision surgery was necessary in 3 cases with multiple zysts of both lungs. One infant has CLO of all lobes of both lungs and still receives treatment.
Discussion: Instrument size of the fiber is minimal, so that thoracoscopic laser surgery can be performed even in neonates. Moreover, excellent sealing of the parenchymal incision surface can be achieved, thus preventing the escape of gas. The procedure can be repeated without development of adhesions and does not disturb following surgery. In 16 of 20 cases endoscopic surgery was the only applied treatment in this life threatening anomalies of infants.
Conclusion: Minimal invasive laser surgery is recommended as „first line" treatment in congenital cystic lung disease.

133

TECHNIQUE AND RESULTS OF THORACOSCOPIC LASER APPLICATION IN NEWBORN AND CHILDREN

J. Waldschmidt, D. Cholewa, K. Hoffmann, A. Kischkel

University Clinic Benjamin Franklin, Dept. Of Pediatric Surgery, FU Berlin, Hindenburgdamm 30, 12200 Berlin, Germany

Purpose: Since the development and improvement of minimally invasive techniques, diseases of the lung, mediastinum and other intrathoracic organs can be surgically managed with the thoracoscope. This includes neonates as well as older children. We use the Neodym-YAG laser 1064 mm with a 0.4 mm quartz fiber for tissue detachment and hemostasis. The youngest child submitted to thoracoscopic surgery was a one-day-old premature infant weighing 1680g. Surgery was performed under general anesthesia with ventilation of both lungs. Lasering has the advantage of sealing the incision so that no gases escape from the ventilated lungs and is also a bloodless procedure. Thus, unimpaired visibility allows tissue-preserving surgery under optimal conditions. We did not observe bronchial fistulas or any other complications.
Method: We evaluated the hospital records of 56 children who underwent thoracoscopic laser surgery. In most cases, there were pulmonary cysts, followed by benign and malignant tumors of the mediastinum, the thoracic wall and the pleura. Other indications were Pericardectomy, lymphangiomas, hemangiomas and leakage of the thoracic duct.
Results: All children tolerated thoracoscopy without complications (no postoperative bleeding, wound infections or parenchymal/bronchial fistulas). Pulmonary cysts recurred once after thoracoscopy and once after thoracotomy. No late complications were observed.
Summery: Thoracoscopic laser application allows tissue-preserving, nontraumatic pediatric surgery with few complications. It is applicable for all pulmonary malformations, congenital diseases and processes in the pericardium, mediastinum and thoracic wall.

134

LASERTREATMENT OF HEMANGIOMAS OF THE GASTROINTESTINAL TRACT

Waldschmidt,J. Hoffmann,K. Doede,Th. Cholewa,D.
University Clinic Benjamin Franklin, Dept. of Pediatric Surgery, Free Universitiy of Berlin, Hindenburgdamm 30, 12200 Berlin, Germany

Hemangiomas of the gastrointestinal tract are rare. They usually become evident by upper and lower gastrointestinal bleeding. Though generally solitary manifestations, cases of multiple localizations are also known. These hemangiomas are often observed in different syndromes (Maffuci syndrome, blue-rubber bleb syndrome, Ossler´s disease) as well as in hemangiomas of the skin and other localizations.
We have treated 11 children with hemangiomas of the gastrointestinal tract. The rectum and sigma were involved most often and less frequently the stomach, duodenum, esophagus or the remaining intestinal segments. All children had in part severe intestinal bleeding which had not been recognized and had thus been left untreated.
Four children required blood transfusions. All children underwent endoscopic intraluminal laser treatment and bleeding was definitively stopped in most cases after the first laser session.
However, 4 to 6 sessions were necessary to achieve complete regression of rectal hemangiomas extending into the pelvis or genitals. The Nd YAG laser was applied in the ITT as well as the contact and noncontact technique.

135

EMERGENCY TREATMENT OF KASABACH-MERRITT SYNDROM BY ND YAG LASER

Waldschmidt,J. Doede, Th. Cholewa,D. Kischkel,A.
University Clinic Benjamin Franklin, Dept. of Pediatric Surgery, Free University of Berlin, Hindenburgdamm 30, 12200 Berlin, Germany

Almost 60 years ago, H:H: Kasabach and K:K: Merritt described the combination of capillar giant hemangiomas and thrombocytopenia. Since this first publication coagulopathies in combination with hemangiomas are appointed to this syndrome. But this is not always correct.
Pronounced thrombocytopenias also occur in hemangioendotheliomas, hemangiomatosis of the spleen, hemolymphangiomas, etc. Sometimes thrombocytopenia is not caused by intrahemangiomatous consumption of platelets and clotting factors but by disseminating intravasal coagulopathies (DIC) with ulceration or infection of the hemangioma and sepsis. Then typical pathologic findings with thrombocytopenia, reduced clotting factors and increased fibrin split products are found.

Patients with Kasabach-Merritt syndrome are usually newborns, whereas the resembling Kasabach-Merritt syndrom coagulopathy is a typical disease of older infants.

We treated 8 children with severe coagulopathy caused by hemangiomas (5 capillar hemangiomas, 2 hemangioendotheliomas, 1 hemangiolymphangiom). We used the Nd-YAG laser 1064 nm in all cases.
The results were good. Hemorrhage could be stopped in all cases and regression of the hemangiomas could be achieved.

136*

LASER-INDUCED THERMOTHERAPY (LITT) OF LIVER METASTASES - DETECTION OF RESIDUAL TUMORS USING GD:DTPA-ENHANCED MRI

Isbert C[1], Germer CT[1], Ritz JP[1], Schilling A[2], Roggan A[3], Wolff KJ[2], Müller G[3], Buhr HJ[1]
[1]Department of Surgery I, [2]Department of Radiology, [3]Institute for Medical/Technical Physics and Laser Medicine
University Medical Center Benjamin Franklin, Frei Universität Berlin, Hindenburgdamm 30, 12200 Berlin, Germany

Purpose: The aim of this study was to examine the sensitivity (SE), specificity (SP) and accuracy (AC) of Gd-DTPA-enhanced MRI (Gd:DTPA-MRI) in the detection of residual tumors after LITT. Methods: LITT was performed in VX-2 tumor-bearing rabbits using Nd-YAG-Laser (1064nm) with a diffuser-tip applicator. The animals were randomized into 4 groups (n=20) and treated at different energy levels (1300-6200 J). Gd:DTPA-MRI and histological examination were carried out at 0 h, 24 h, 96 h and 14 d after LITT. Results: Lesions showed zonal architecture, a transmission (TZ) and reference zone (RZ) were detectable. Complete tumor ablation were seen in 33 animals, 47 animals developed local recurrences. Gd:DTPA-MRI detection of residual tumors was based on the calculated signal intensities (SI's) [>2 or <2] of TZ and RZ. An SE of 92%, an SP of 100% and an AC of 100% were found in TZ 24 hours after LITT. The SE was 0%, the SP 100% and the AC 45% in the RZ. An SE of 100%, an SP of 11% and an AC of 60% were measured in the TZ fourteen days after LITT. The SE was 100%, the SP 89% and the AC 95%. Histologically, there were intra- and extralesional recurrences (satellite metastases). Intralesional tumor recurrence was caused by the thermoprotective effect of vascular structures on perivascular tumor cell units. Conclusions: Intra- and extralesional tumor recurrence was detected by Gd:DTPA-MRI with an AC of 95%. This procedure should be performed 24 h, 96 h and 14 d after LITT.

137*

LASER-INDUCED THERMOTHERAPY (LITT) OF LIVER METASTASES - ENERGY AND TEMPERATURE DETERMINATION FOR COMPLETE TUMOR-IN-SITU-ABLATION

Germer CT[1], Isbert C[1], Ritz JP[1], Schilling A[2], Roggan A[3], Müller G[3], Buhr HJ[1]
[1]Department of Surgery [2]Department of Radiology, [3]Institute for Medical/Technical Physics and Laser Medicine
University Medical Center Benjamin Franklin, Freie Universität Berlin, Hindenburgdamm 30, 12200 Berlin, Germany

Purpose: The aim of this study was to determine the energy (J/mm^3 tumor volume) and temperature required for a complete in-situ-ablation of experimental liver tumors. Methods: LITT was performed in VX-2 tumor-bearing rabbits using Nd-YAG-Laser (1064nm) with a diffuser-tip applicator and a temperature feedback-system. The animals were randomized into 4 groups (n=20) that differed in the target temperature at the tumor border [45°C, 50°C, 55°C and 60°C]. Histological examination was done at 0 h, 24 h, 96 h and 14 days after LITT. Results: The pretreatment tumor volume of 2191±61 mm^3 was the same for all groups (p>0.05). Energy and temperature required and the rate of incomplete tumor-ablation (recurrences) are listed below (*=p<0.05, Kruskal-Wallis test.

	45°C	50°C	50°C	50°C
Joule up to target temperature	410,8±28	923±98	1497±100	3210±212
Joule total	1380±77	2224±180	3657±203	6198±255
Lesion size (mm³)	1774±205 *	2829±438 *	3780±334 *	4190±347 *
Recurrence	20	16	10	1

Conclusions: 1) To achieve complete in-situ-ablation under the given conditions, it is necessary to apply laser-energy of 3 J/mm^3 tumor volume. 2) A minimum temperature of 60°C on the tumor border presumed an application of 10 minutes.

138

EFFECTIVITY OF LASER-INDUCED THERMOTHERAPY AFTER SELECTIVE OCCLUSION OF HEPATIC PERFUSION

J.-P. Ritz[1], C.T. Germer[1], A. Roggan[2], C.Isbert[1], J. Pelz[1], H.J.Buhr[1], Dept. of General Surgery[1], Dept. of Laser Medicine[2], University Hospital Benjamin Franklin, Freie Universität Berlin, Germany

Laser-induced thermotherapy (LITT) is a promising treatment for destroying liver tumors. Aim of this experimental study was to evaluate the influence of selective occlusion of hepatic perfusion (arterial, portal vein, microembolisation) on lesion size, tumor growth and hyperthermic effectivity of LITT. In 75 rats an adenocarcinoma cell line was implanted into the liver. Animals were grouped into control group ($LITT_{mono}$), selective or combined arterial and venous occlusion ($LITT_{artery}$, $LITT_{vein}$, $LITT_{artery+vein}$) and temporary arterial microembolisation using degradable starch microspheres ($LITT_{DSM}$). Tumor vitality was determined immunohistologically 24h, 7days and 21 days after LITT (Nd-YAG-laser, 1200 J). An increase in lesion volume was found in $LITT_{artery}$, $LITT_{vein}$, and $LITT_{artery+vein}$. Vital tumor remnants were found in 1 animal each from the $LITT_{DSM}$ and $LITT_{artery+vein}$. group in contrast to 3 animals of $LITT_{artery}$ and 6 of the $LITT_{vein}$ group (p<0,01).

	tumor volume (mm³)	lesion volume (mm³)	Vital tumor tissue (n)
$LITT_{mono}$	617,3 (±39,8)	730,5 (±48,8)	15 / 15
$LITT_{DSM}$	619,4 (±36,5)	740,8 (±38.1)	1 / 15
$LITT_{artery}$	615,6 (±38,7)	1405,8 (±77,2)	3 / 15
$LITT_{vein}$	611,4 (±34,8)	1306,9 (±66,1)	6 / 15
$LITT_{artery+vein}$	617,4 (±38,8)	4095,7 (±330,2)	1 / 15

The selective arterial or portal vein occlusion of hepatic inflow is not suitable for a sufficient tumor treatment in LITT. In significantly smaller lesion volumes $LITT_{DSM}$ led to the same tumor elimination as complete interruption of liver perfusion. The significant smaller lesion size in $LITT_{DSM}$ implicates an protective effect on healthy liver tissue without loss in efficiency.

139

MAGNETIC-RESONANCE-CONTROLLED HIGH POWER COOLED INTERSTITIAL LASER THERAPY FOR THE TREATMENT OF CONGENITAL VASCULAR DISORDERS

D. Cholewa, F.Wacker, E.Rohde, A.Roggan, K.J. Wolf, J.Waldschmidt
University Clinic Benjamin Franklin, FU Berlin, Hindenburgdamm 30, 12220 Berlin, Germany

Background and Objective: Experience with interstitial laser therapy (ILT) has shown that the largest volumes can be achieved using diffusing laser applicators with a cooled catheter system.

Study Design/Patients and Methods: In our study we investigated the use of cooled applicators in ILT of voluminous vascular disorders (CVD) under open magnetic resonance imaging (MRI) control in 5 children. The Nd:YAG laser was used with a power setting of 25 W. The applicators with an active length of 2 cm (outer diameter 1.1 mm, core diameter 400 µm) were introduced into the thermostabile Teflon double tube catheter with an outer diameter of 3 mm. Iso-osmolar solution with a para-axial flow of 50 ml/min was used for the cooling of applicators during the laser procedure.

Results: MR-guided puncture enabled precise and easy positioning of applicators by passive tip tracking. On-line thermometry was possible in all 30 therapy procedures. The volume of tissue changes observed in MRI ranged from 12 to 36 ml (mean: 22.5 ml). When a bare fiber

was used during previous treatments, lesions with a mean volume of *only* 2 ml could be seen in MRI. The 6-week follow up revealed a reduction of tumor volumes in all patients. Clinical symptoms improved in 4 out of 5 patients.

Conclusion: Our first cases have showed that MR-guided ILT of CVD may be more effective if cooled laser applicator systems are used.

140*

Nd-YAG LASER THERAPY FOR THE EXCISION OF PILONIDAL CYSTS: A COMPARISON WITH TRADITIONAL TECHNIQUES

A Palesty, KS Zahir, SJ Dudrick & G Tripodi
(St. Mary's Hospital Dept. of Surgery & Yale School of Medicine)

Nd-YAG laser therapy has been widely accepted as a modality for the treatment of hemorrhoidal disease. Very little has been reported on its use and effectiveness in treating pilonidal disease. We hypothesized that laser therapy would be an excellent tool for pilonidal cystectomy, facilitating clean incision, less bleeding, predictable tissue effects, decreased operating room time and decreased postoperative pain with an earlier return to work and a shorter recovery period.

A retrospective study was carried out for the five year period from 1993-1997, comparing Nd-YAG laser versus standard surgical technique. A telephone questionnaire addressing surgical parameters, pain, and return to daily activities were assessed.

Operative time for the traditional pilonidal cyst excision group was 20 minutes longer than those excised using the Nd-YAG laser, however, hospital stay postoperatively was similar. Laser treated patients returned to work 2.4 days earlier, and their post-operative pain was less than those treated with traditional techniques.

In an era when the medical consumer makes decisions based on the efficacy of treatment using criteria such as pain, length of hospitalization and speed of return to work, Nd-YAG lasers have emerged as a surgical tool that can fulfill these criteria for certain procedures. Patient postoperative satisfaction following laser excision of pilonidal cysts was significantly greater when compared with those who had excision with traditional techniques. Their initial postoperative pain was less as was the pain experienced during the first week of recovery. Cost of Nd-YAG laser excision was comparable to that of the traditional method and our review supports its use as a cost effective technique that should be used preferentially because it is accompanied by less pain and allows for earlier return to work.

141

ND-YAG LASER IMPROVES QUALITY OF LIFE AND ECONOMIC FACTORS IN HEMORRHOID SURGERY

KS Zahir, RE Edwards, A Vecchia, SJ Dudrick & G Tripodi
(St. Mary's Hospital Dept. of Surgery & Yale School of Medicine)

Because hemorrhoidal disease is a very common health problem and economic issues have suggested that surgical use of the laser may be beneficial in conditions in which surgical recovery time, postoperative hospital stay and complications may minimized, we evaluated the differences in quality of life in elective hemorrhoidectomy patients with and without use of the laser.

The charts of 50 patients having hemorrhoidectomy procedures from 1993 - 1997 were reviewed retrospectively to evaluate postoperative pain, time period required to return to work, postoperative complications, and overall patient satisfaction. Statistical analysis was done with non-paired t- tests.

Postoperative laser treated hemorrhoidectomy patients used significantly less pain medication and experienced much less pain than the standard hemorrhoidectomy patients. One week after surgery, the laser treated patients had 65% less pain than the standard hemorrhoidectomy patients based on a pain intensity scale. Postoperative painless defecation occurred earlier in the laser treated patients by 5 days. Postoperative drainage was noted to be 148% greater in the standard hemorrhoidectomy patients. Overall surgical costs were lower by 27%, and total hospital costs were lower by 11% than the respective standard hemorrhoidectomy patient costs. Eighty percent of the laser patients versus forty four percent of the standard patients resumed work at one week after surgery.

Patients who underwent Nd-YAG laser hemorrhoid surgery had less pain on the first postoperative day and week with an earlier return of painless defecation. Laser treated patients incurred less cost for surgery. Beneficial outcomes of intraoperative laser treatment in hemorrhoid ablation is important for patient satisfaction, quality of life, cost containment and earlier return to work.

142

UNLIMITED USE OF LASER FOR GYNAECOLOGICAL SURGERY

Roxana Chapman
Cromwell Hospital, Portland Hospital, and University College Hospital Private Wing, London, U.K.

The object is to prove that all but a minority of gynaecological disorders can be satisfactorily and safely dealt with by laser surgery by presenting a personal series of 1,000 consecutive gynaecological endoscopic laser cases treated and followed up over a 10 year period. This includes pioneering work on the treatment of uterine leiomyomas, adenomyosis and severe Asherman's syndrome.

In this study four different types of laser have been employed, namely, the carbon dioxide laser of 10,600 nm wavelength, the neodymium: yttrium-aluminium-garnet laser of 1,064 nm, the Diode laser of 810 nm and the potassium-titanyl-phosphate laser of 532 nm wavelength and it is shown that the appropriate wavelength should be tailored for use on the appropriate pathology. Furthermore, it will be shown that non-contact, near contact, contact and interstitial modes are all appropriate under certain circumstances, as, indeed, is the energy used.

In none of the cases did serious complication arise and failure of treatment occurred in less than 0.5%. There was a reduction of morbidity and mortality over traditional surgery together with shortened bed occupancy, and financial savings for patient, hospital and nation.

143

Capability of optical coherence tomography in control of treatment of cervical pathology.

N. Shakhova, I. Kuznetzova, T. Kachalina, N. Gladkova, V.Gelikonov*, G.Gelikonov*.

Medical Academy of Nizhny Novgorod, Russia
*Institute of Applied Physics of Russian Academy of Sciences, Uljanov , st. 46, 603600, Nizhny Novgorod, Russia

We present the new non-invasive method for examination of cervix. Optical coherence tomography(OCT) is cross-sectional imaging similar to ultrasound B-scan, but based on interferometric detection of reflected near infrared radiation. First results of our research demonstrate the capability of OCT in vivo detection of structural and some physiological alterations of cervical epithelium and underlying stroma to the depth of 1-2 mm with 10-15 μm resolution. The OCT image (200x200 pixels) is acquired and visualized in 1 sec.

More than 100 female patients have been examined in Gynecological Department of N.Novgorod Regional Hospital. OCT criteria of healthy mucous membrane have been formulated, several signs of the pathological and physiological alterations have been studied. Obtained OCT data clearly correlate with well-known data about vasodilatation, liquid accumulation, tissue edema with formation of necrosis area following electro-, cryo- and laser surgery. Subsequent healing process is accompanied with a recovery of well organized spatial structure. This information allows clinicians to estimate exact size of pathological area for monitoring of treatment and healing process .

Thus OCT is hoped to become the method for control of adequacy of minimal invasive procedures and patient's follow up.

NEUROSURGERY

147

Indications and Applications of laser Thermodiskoplasty for Spinal Disc Disease – 600 cases.

John C. Chiu, Thomas Clifford, Richard C. Richley, Mark Greenspan, Felix Negron, Robert A. Princenthal, Joan Carter, California Center for Minimally Invasive Spine Surgery, Thousand Oaks, CA, Laser Spine and Joint Surgery of California, San Diego, CA, Arthroscopic and Orthopedic Surgery, Sherman Oaks, CA, Westlake MRI, Westlake Village, CA, Trimedyne, Irvine, CA

Purpose: To demonstrate and to describe the collagen and disc shrinkage effect of Holmium laser at lower non-ablative energy level (laser thermodiskoplasty) with ease, safety and efficacy of this outpatient Holmium laser percutaneous microdecompressive endoscopic spinal discectomy performed for symptomatic non-extruded herniated nucleus pulposus at cervical, thoracic and lumbar spine.

Materials and Methods: Since 1995, 600 cases, 1020 spinal discs, still symptomatic in spite of at least 12 weeks of conservative care, were treated with percutaneous microdecompressive endoscopic spinal discectomy and low level non-ablative Holmium laser thermodiskoplasty, i.e., collagen tissue and disc shrinking/tightening Holmium laser. All cervical and lumbar herniated discs demonstrated unilateral radicular pain of a specific dermatome confirmed with EMG/NCV. MRI or CT scans demonstrated a contained soft intervertebral disc herniation in all cases. The levels of the discs included 539 lumbar discs, 419 cervical discs, and 62 thoracic discs.

Results: Postoperative follow-up demonstrates 95.2% (571 patients) of all patients did well (good to excellent). There were no intraoperative or postoperative complications. Nine patients demonstrated persistent mild residual pain and paresthesia. The average time to return to work was ten days for the non-workers' compensation patients. A computerized finite element model of the herniated disc, pre and post laser discectomy with collagen tissue tightening or shrinkage, i.e., laser thermodiskoplasty at the collar and the shoulder of the disc is presented. It demonstrates the results of a computerized model for laser induced collagen tissue and the disc shrinkage and contraction for the purpose of disc decompression in spinal discectomy.

Conclusion: This new Holmium laser thermodiskoplasty technique in laser percutaneous microdecompressive endoscopic spinal discectomy appears to be easy, safe and efficacious. This less traumatic, easier outpatient treatment leads to excellent results, faster recovery, and significant economic savings.

148

INTERACTIVE IMAGE-GUIDED NEUROSURGERY USING A ROBOTIC MICROSCOPE INTEGRATED WITH AN INFRARED-BASED SYSTEM

Amgad Matter, Lucia Zamorano, Juan C. Benedetti, Federico C. Vinas, Fernando Diaz
Wayne State University

Between September 1996 and July 1998, we have performed 40 interactive image-guided procedures for 39 patients using the MKM robotic microscope. There were 20 females and 19 males. The age ranged between 3 to 77 years (mean 43). Twelve patients had glioblastoma multiforme, 6 had brain metastasis, 5 had anaplastic astrocytomas, 5 had vascular malformations (4 cavernous malformations and 1 AVM), 3 had meningiomas, 2 had colloid cysts, 2 had anaplastic oligoastrocytomas, 2 had low grade gliomas, 1 had pituitary adenoma, and 1 had choroid plexus papilloma. The lesion locations were 16 frontal, 10 temporal, 5 ventricular, 4 parietal, 2 cerebellar, 1 occipital, 1 dorsum sella, and 1 pituitary. Preoperatively, 9 patients were neurologically intact, 15 had mild neurological deficits, 15 had moderate neurological deficits, and 1 had severe neurological deficits. The preoperative Karnofsky score (KPS) ranged from 50 to 100 (mean 85). For those lesions located near or within eloquent areas (29 procedures), an awake craniotomy with functional cortical and subcortical mapping was performed. In 15 procedures complete surgical resection was achieved as demonstrated by postoperative magnetic resonance imaging studies, and it was subtotal in 25 procedures. The postoperative neurological status remained the same after 31 procedures, improved after 5 procedures, and got worse after 4 procedures. The postoperative KPS ranged from 50 to 100 (mean 86). The median hospital stay was 3 days and the mean ICU stay was 1 day. There was no operative mortality. We conclude that interactive image-guided surgery with the robotic microscope represents a very accurate and safe technique in the surgical treatment of intracranial lesions.

149

COMPUTER ASSISTED RESECTION OF CEREBRAL CAVERNOUS ANGIOMAS

Lucia Zamorano, Amgad Matter, Juan C. Benedetti, Fernando Diaz
Wayne State University

Small, deep CAs within the cerebral hemispheres and/or near eloquent areas are difficult to localize and resect without significant morbidity. We present the our experience in the computer-assisted surgical resection of deep cavernous angiomas using an infra-red based system. From July 1992 to February 1998, 21 patients underwent interactive image guided resection of their lesions. Age ranged from 6 to 62 years (mean 34). Clinical presentation was: seizures (n=11), headache (n=4) and hemorrhage (n=6). The location of the lesions was: Temporal (n=11), frontal-parietal (n=7), thalamus (n=1), basal ganglia (n=1) and pons (n=1). Preoperatively a CT scan and MRI were obtained under stereotactic conditions using a frame-based and frameless techniques. For those lesions located near or within eloquent areas (n=12), an awake craniotomy with functional cortical and subcortical mapping was performed. An infra-red system was used intraoperatively to confirm the location and the exent of the resection of these lesions in real time. Clinical follow-up ranged from 3 to 62 months (mean 27). In all 21 patients complete surgical resection was achieved as demostrated by MRI postoperatively. Two patients presented postoperatively with transient neurological deficitis that cleared over a six month period, one had a lesion in the pons, he had multiple

cranial nerve deficits postoperatively,which gradually improved. There was no associated mortality. Clinical follow-up revealed that 18 patients (85.7%) experienced complete recovery of preoperative symptoms and 3 patients (14.3%) with seizures showed marked improvement. Interactive image guided surgery for deep seated cavernous angiomas represents a very accurate and safe approach for these lesions.

150

LASER DIAGNOSIS AND TREATMENT OF DEEP-SEATED BRAIN LESIONS

Helen Anne Ward
Medical Health and Research Centre, Randwick NSW 2031 Australia

The five year survival rate of deep-seated malignant brain tumours after surgery/radiotherapy is virtually 100% mortality. Special problems include: (1) Lesions often present late; (2) Position - lesion overlies vital structures, so complete surgical/radiotherapy lesion destruction can damage vital brain-stem functions; (3) Difficulty in differentiating normal brain from malignant lesions.

The aim and method of this study was to use the unique properties of the laser: (a) to minimise damage during surgical removal of deep-seated brain lesions by operating via fine optic fibres; and (b) to employ the propensity of certain lasers for absorption of (non toxic) dyes and absorption and induction of fluorescence in some brain substances, to differentiate borders of malignant and normal brain, for more complete tumour removal. The project resulted in a fine laser endoscopic technique for removal of brain lesions, which minimised thermal damage and shock waves. A compatible endoscopic fluoroscopic laser technique was developed. This differentiated brain tumour from normal brain.

It was concluded that by utilising special properties of coherent light wavelengths, a more precise, less damaging technique for laser removal/diagnosis of brain tumours was achieved.

151

PHOTODYNAMIC THERAPY OF MALIGNANT BRAIN TUMORS: RESULTS FROM A PHASE 2 TRIAL AND DEMOGRAPHICS FROM A PHASE 3 TRIAL

Paul Muller, Michael Hitchcock, Robert Fenstermaker, Brian Wilson, Fred Hetzel, Lothar Lilge, and Qun Chen, St. Michael's Hospital and the Princess Margaret Hospital University of Toronto; the Swedish Medical Center, HealthONE, Denver, and Roswell Park Memorial Institute, Buffalo

Photodynamic therapy (PDT) is a promising new local treatment for malignant tumors. Malignant astrocytic brain tumors infiltrate and expand locally in the brain and do not metastasize outside the nervous system. Morbitity and death are the consequence of their local effects. Thus, PDT may be particularly suited to the therapy of these tumors since improved local control could result in an increase in survival.

Noted below are the results in 82 patients with supratentorial gliomas accrued in phase 2 studies at St. Michael's Hospital. These patients received 2mg/kg Photofin i.v. 12-36 hours prior to surgical resection of their tumor or tumor cyst drainage. The surgical mortality rate in our series is 3%. The combined serious mortality-morbidity rate is 8%.

There were 62 recurrent patients who had failed previous surgery and radiotherapy. The energy density range was 8–150 J/cm^2 and the delivered light energy range was 440–7200 J [median=1700J]. The median survival times in weeks for glioblastoma, malignant astrocytoma, malignant mixed astrocytoma-oligodendroglioma and ependymoma were 30, 40, >56 and >174 weeks, respectively. Eight patients with recurrent GBM whc received >60 J/cm^2 had a median survival of 58 weeks and 24 patients who received <60 J/cm^2 survived 29 weeks. The survival of patients with recurrent glioblastoma who undergo surgical treatment alone is only 20 weeks.

There were 20 patients with newly diagnosed malignant supratentorial gliomas. The energy density range was 15–110 J/cm^2 [median=32 J/cm^2] and the delivered light energy range was 570–4050 J [median=1260J]. All but two had post-operative radiation therapy [5000 cGy in 5 weeks]. The median survival of 11 patients with glioblastoma was 37 weeks with a 1 and 2 year survival of 35% and 0%, respectively and the median survival for 9 patients with malignant astrocytoma was 48 weeks with a 1 and 2 year survival of 44% and 33%, respectively. Six patients with a Karnofsky score of >70 who received a light dose of >1260J [mean energy density = 62 ± 20 sem J/cm^2] had a median survival of 92 weeks with a 1 and 2 year survival of 83% and 33%, respectively.

PDT is safe in patients with either newly diagnosed or recurrent supratentorial malignant gliomas. There appears to be prolongation of survival in selected patients when an adequate light dose is used. A controlled clinical trial of the addition of PDT to radiotherapy and chemotherapy of supratentorial malignant astrocytic brain tumors has been initiated; more than 30 patients have been accrued to date. The demographics of these phase 3 patients and the techniques of intraoperative cavitary photoillumination will be described.

NEW DEVICES

155*

RECENT DEVELOPMENTS IN DIODE LASERS.

F. Durville, Cynosure, Inc., Chelmsford, MA.

Diode lasers are very powerful and effective tools to deliver heat in a highly controlled and selective manner. They are highly efficient, very reliable, and can be manufactured in high volume at low cost. Recent developments and new applications have led to a significant increase in power output, brightness and reliability, as well as a significant cost reduction. However, the use of optical fiber to deliver the laser energy is very desirable in many applications, and diode lasers remain difficult to efficiently couple into standard optical fibers due to their large beam asymmetry. In addition, diode lasers still generate a significant amount of heat in a very small size. By carefully designing an appropriate cooling system, and being able to efficiently couple the diode lasers into optical fibers, new promising devices can be developed. As an example, Cynosure, Inc. has recently developed three new diode laser systems. The first system is a pulsed, high power system useful for applications such as hair removal. It delivers up to 10 J per pulse with a pulse duration of up to 50-msec and rep rate up to 5 Hz at a wavelength of 800 nm. The second system delivers up to 10 W cw at a wavelength of 688 nm out of a disposable 600-μm fiber. The third system delivers up to 10 W cw at a wavelength of 980 nm out of a small 100-μm fiber. I will review the main issues related to diode laser technology and some of the basic recent developments that enabled us to develop these new devices.

156

HIGH POWER DIODE LASERS – NEW PERSPECTIVES IN MEDICINE

K.Frank*, W.Rother**, W.Hiereth**
Dornier Surgical Products Inc., 1155 Roberts Boulev. Kennesaw GA, 30144, USA. **Dornier Medizin Laser GmbH, Industriestr. 15, 82110 Germering, Germany

The Dornier Medilas D laser is the perfect combination of easy portability and high powered efficiency. Although diode lasers have been on the market for years, we have replaced the conventional fiber coupling technique with the

more efficient diode module technique. With this technique, individual bars of high performance diodes are combined into a single block with integral cooling. The laser light is then focused by micro optics and coupled directly into the laser fiber which results in an improved beam quality without hot and cold spots. Photo biological tests have shown the 940 nm wavelength of this laser to be idea for light colored absorption in water and blood. This provides excellent coagulation and vaporization effects along with precise tissue cutting without bleeding.

The solid state technology and durable construction of the Medilas D make this laser easy to service and easy to transport. Its compact design and low weight are suitable for ceiling mount installation, a built in unit in a laparascopy or endoscopy rack, or as a free standing unit with a minimum footprint in a physician's office setting. A telescoping handle even allows the unit to be rolled down a hallway with little effort.

Along with its 50w power output, the extremely long operating life of the diodes and the fact that no pumping lamp is required provide high economy and low maintenance. Ideal for ENT and endoscopy as well as urology and a variety of surgical applications the Medilas D is approved for:

-Coagulation and contact vaporization of tissue
-Non-contact coagulation of vascular lesions
-Vaporization of tumor stenoses in narrow hollow organs with minimal bleeding
-Percutaneous tissue ablation
-Resection and preparation of tissue during surgical or laparascopic intervention

157*

LONG PULSE, HIGH ENERGY ALEXANDRITE LASER FOR HAIR REMOVAL AND VASCULAR LESIONS

James C. Hsia, Candela Corp, Wayland, MA.

The optimal laser parameters for safe and effective hair removal are dictated by the need to deliver sufficient laser energy to injure the hair follicles without excessive non-specific skin injury. The need for deep light penetration and good hair follicle absorption point to wavelengths in the near infrared and large area treatment beams. The high fluences required and the need to cover large skin surface areas in reasonable treatment times point to high pulse energies and high average powers. Selective photothermolysis considerations indicate pulse durations in the millisecond regime. The need to minimize collateral injury to the epidermis can be met by adjunctive active skin surface cooling. These requirements are discussed. The Candela GentleLase is designed specifically with these considerations in mind. Tissue optics and thermal modeling as well as clinical results using the GentleLase will be presented.

158*

Unique Laser for Ophthalmology

Authors: C. Cozean, Ph.D. & R. Kojima
Premier Laser Systems, Inc.

Premier Laser Systems found a unique market for a dual port Er:YAG laser system. The laser, initially design strictly for surgeons and ophthalmologists, was modified to be a dual port system. This dual port laser can be marketed in the surgi-centers since several different types of surgeries are performed at these centers. It would only be necessary for the surgi-centers to purchase a single laser to perform a multitude of procedures using the Er:YAG wavelength instead of two or more laser systems. The laser can delivery Er:YAG energy through the fiber optic delivery port for surgical and ophthalmic procedures and also through the articulated arm port with the use of a handheld scanner for dermabrasion procedures.

The microprocessed controlled laser system called Dermium Er:YAG laser system has been interfaced with a handheld scanner system which communicates with the laser. This interaction between the scanner and laser makes the operation of the Dermium Er:YAG laser system safe. The Dermium Er:YAG laser system has interlock mechanisms to prevent unsafe firing of the laser.

There have been other disciplines that are interested in this dual port type of laser system which will lessen the financial burden of certain practices throughout the world.

159

EFFECTS OF AN ER,CR: YSGG LASER HYDROKINETIC SYSTEM ON BIOCALCIFIED DENTAL TISSUES

I.M. Rizoiu* and L.R. Eversole**
*BioLase Technology Inc. and **University of the Pacific

An Er, Cr: YSGG laser utilizing an air and water spray and a fiber optic delivery system is capable of cutting enamel, dentin and bone. A series of investigations assess the hydrokinetic mechanisms of hard tissue cutting, biological effects on dental tissues and bone, cut surface physical characteristics and resin bonding to teeth. High speed videophotography and phase doppler analyses have disclosed that focused laser energy bombardment of water droplets results in microexplosive hydrokinetics. The hypothesis that accelerated water is a major factor in hard tissue cutting is supported by the fact that hydrated and xylene dehydrated teeth are cut at comparable rates.

In order to investigate the potential pulpal pathological effects New Zeland White Rabbits with open apexes and continuously erupting central incisors and Beagle dogs with closed apex posterior teeth were divided into several sacrificed groups (24 hrs, 48 hrs, 7 days, 30 days and 3 months). The teeth were decalcified and histologic sections were prepared. The pulps failed to show any inflammatory changes underlying cavity preparations made with the laser HKS. Bonding strength properties of laser HKS vs. dental drill were assessed in vitro on human molars. After preparation of surfaces, both drill and laser HKS cuts with bonded composite cylinders were tested on an Instron test machine. Results showed a statistically significant difference (<.001) between the laser HKS non-etched enamel group (SBS = 20.5 +/- 2.79 MPa) and the drill non-etched enamel group (SBS = 8.65 +/- 4.31 MPa) and no significant difference between the etched enamel groups.

On the basis of our studies, it is concluded that near pulp cavity preparations do not result in pulpal damage, inflammation or necrosis and laser HKS cut enamel surfaces can retain restorative resin materials.

160*

MICROSECOND PULSED CARBON DIOXIDE LASERS FOR SURGERY

Lou Reinisch
Department of Otolaryngology, Vanderbilt Bill Wilkerson Center for Otolaryngology and Communication Sciences, Nashville, Tennessee

The laser offers many advantages for use in surgery. However, the laser incision is associated with lateral thermal damage and a delay on wound healing. We have investigated several methods to reduce the lateral thermal damage and decrease the delay in wound healing. Our latest investigations with incisions are made using a carbon dioxide laser using 4 to 10 μs long pulses (Argus Photonics Group, Jupiter FL). These studies show that we are able to control the amount of lateral thermal damage using the pulse repetition rate. With sufficiently slow repetition rates, the lateral damage is minimal and the laser wound heals similar to a scalpel wound. With faster repetition rates, increased hemostasis is accompanied by increased lateral thermal damage. The microsecond pulsed carbon dioxide laser is probably the next generation of "work-horse" lasers for surgery.

161*

SapphIRe® OPTICAL FIBER & ERBIUM LASER: SURGICAL DEVICE ENGINEERING CONSIDERATIONS

Gary B. Hayes, Jeremiah J. Fitzgibbon, Joseph Collins, Aaron Robbins
Saphikon, Inc., Milford, NH

Sapphire fibers grown using the Saphikon EFG™ technique have proven to be effective in delivery of high energy laser light from Er:YAG and Er:YSGG lasers. The purpose of our study is to characterize the properties of the fiber, thus providing design parameters for engineers and physicians to develop robust surgical delivery systems and efficient surgical techniques.

The results of our investigations show that sapphire fibers ranging in diameters from 150 microns to 1mm, can be consistently manufactured with losses <1.0dB/meter at the 2.94 micron wavelength. Fibers exhibit damage thresholds over 1200 Joules/cm^2 and can be used at temperatures up to 2000°C. We have successfully placed a Teflon buffer on the "core only" fiber, with no change in transmission values or effective numerical aperture which is measured to be 0.12. As an example, the 425 micron fiber has a minimum bend radius of 80mm. A bend-limiting armored cable can also be applied. Fiber-to-fiber coupling at high energy is achieved, allowing for disposable surgical tips in a variety of configurations.

We have easily ablated bone with a 425 micron tip and 100mJ, 200usec pulses. In near-contact with a fluid environment, excellent cuts with minimal zones of surrounding damage are produced. Angled, chisel and blade scalpel tips have been demonstrated. In conclusion, sapphire optical fiber is an enabling technology for efficient precise removal of soft and hard tissues throughout the body with erbium laser wavelengths.

162*

THE DIAMOND LASERKNIFE

Larry Osterink and William Fountain, Clinicon Corporation; W. Gregory Chernoff, Chernoff Plastic Surgery & Laser Center

The "Diamond LaserKnife" is a precision surgical scalpel that uses CO_2 laser energy transmitted through the sides of the diamond blade to simultaneously cauterize biological tissue. Cauterization depth can be independently controlled.

The purpose of this study is to evaluate the cutting and cauterizing efficacy in human tissue of various configurations of the "Diamond LaserKnife". Optical field patterns and energy levels are measured and correlated to the effectiveness of hemostasis. Cutting with cauterization on recently excised and living dermal and epidermal tissue is performed, and pathology slides are prepared to deter-mine efficacy under various conditions.

Preliminary results have demonstrated high-precision cutting and effective cauterization from both "spear" and "lance" blade configurations.

163*

PHOTOTHERMAL LASER CAUTERY SYSTEM.

F. Durville, R. Rediker, Cynosure, Inc., Chelmsford, MA
R.Connolly, S. Schwaitzberg, J. Lantis, New England Medical Center, Boston, MA.

Hemostasis, the stopping or prevention of blood loss, is a matter of urgent concern in many areas of trauma care and clinical medicine including surgery, trauma and obstetrics. We have developed a new device and procedure to effectively and quickly stop bleeding. The new device uses a small, 5 W diode laser to heat-up the tip of a modified medical forceps. The laser diode source is a linear array or bar of 7 emitters each 100 μm wide. Each emitter can generate up to 1.5 W very reliably and is directly coupled into a small 110 μm-diameter fiber. The 7 fibers from the 7 emitters are then simply bundled together into a bundle of 450-μm diameter and 0.12 Numerical Aperture. The laser delivers over 7 W out of the fiber bundle at a current of approximately 11 A through the laser bar. The 5 W laser system is build as a Class I laser system since the laser beam is fully enclosed in a protective housing. The system further incorporates a fail-safe fiber interlock. The device was first evaluated in animal models to quickly and effectively cauterize various blood vessels. Veins and arteries in the mesentery tissue of live, anesthetized rabbits of up to 1.5 mm diameter were quickly and effectively cauterized with approximately 5 seconds of activation time. The device was also used successfully to cauterize the aorta of a rabbit. When compared with standard monopolar electrocautery device, our laser device is more effective and safer with much less heat spread and essentially no risk of collateral damage. The new device, originally targeted for use in the field to stop internal bleeding, has been successfully used in clinical trials to provide hemostasis during standard open abdominal surgery such as hernia repair.

164

AN INTEGRATING BALLOON DELIVERY DEVICE FOR PHOTODYNAMIC THERAPY

P. J. Dwyer, W. M. White, R. L. Fabian, R. R. Anderson,
Wellman Laboratories of Photomedicine,
Massachusetts General Hospital, Boston, MA

It is frequently difficult to deliver uniform and efficient light over the complex shapes presented by various organs for photodynamic therapy (PDT). A medical grade, silicone balloon delivery device for photodynamic therapy was designed and

tested for the treatment of various anatomical tissues. The device uses the principle of optical integration by multiple internal diffuse reflections to achieve uniform output illumination. Soft, white, medical-grade silicone balloons with titanium dioxide (TiO_2) were made and tested for performance. The balloon is cast to the shape of the target tissue surface, organ or cavity. Laser power is introduced into the saline-filled balloon by fiber optics. Integrating balloon devices were constructed and used to illuminate the oral mucosa and uterine endometrium. Balloons were tested for uniformity, efficiency, and optical power capabilities. The balloon wall was constructed to have very low optical absorption, high diffuse reflectivity (80 to 95%), and low diffuse transmittance (T=1-R, 5 to 20%) in the 600-900 nm wavelength region. Power capability of 3.5 watts input (600-900 nm wavelength) were achieved without thermal damage to the device. Optical efficiencies of 65% are typical with emitted light uniformity of 90% +/- 10% over complex nonspherical surfaces. Efficiency increased slightly with inflation of the device past the conformed volume. Uniformity and efficiency are not strongly affected by balloon inflation and the devices are robust and easy to produce in essentially any shape for any target tissue.

165

ORBSCAN CORNEAL TOPOGRAPHY LASER-LINK SYSTEMS. Timothy N. Turner, Ph.D., Director of Research, Orbtek, Salt Lake City, Utah. Charles Broadus, Director of Engineering, Orbtek.

Purpose: To calculate customized laser ablation patterns for surgical correction of myopic and hyperopic eyes with astigmatism and irregularities.

Methods: First and second generation systems have been developed: Corneal Interactive Programmed Topographic Ablation (CIPTA) and Wavefront Ablation Vision Enhancement (WAVE). CIPTA uses ORBSCAN measured elevation and the final targeted shape to calculate the ablation pattern. The target shape is ellipsoidal to compensate for posterior corneal and lenticular astigmatism and corneal prolateness. Various methods are used to construct smooth transition zones. WAVE is a second generation method to construct a general surface that nulls all central wavefront aberration.

Results: To date CIPTA has undergone clinical trials on about 150 eyes in Italy with very satisfactory results.

Conclusions: Topography assisted laser surgery has been a much lauded goal. These two ORBSCAN systems take the first steps towards making this a reality.

166*

TRANSMYOCARDIAL REVASCULARIZATION USING A HOLMIUM YAG LASER Keith B. Allen, St. Vincent Hospital, Indianapolis, IN; Tommy L. Fudge, Terrebone General Medical Center, Houma, LA; G Phillip Schoettle Jr, Methodist Hospital, Memphis, TN; Samuel L. Sellinger, Sacred Heart Hospital, Spokane, WA; Carl J. Shaar, St. Vincent Hospital, Indianapolis, IN; Robert D. Dowling, Jewish Hospital

The objective of this effort was to evaluate the safety and efficacy of transmyocardial revascularization (TMR) in patients with refractory Class IV angina and disease not amenable to percutaneous or other surgical intervention. Between March 1996 and February 1997, 160 patients were randomized to receive TMR (n=74) or continue maximal medical management (n=86). Demographics were similar in both groups. At the end of 12 months, 81% of the TMR patients had an improvement of $\geq$ 2 angina classes compared to 31% of patients who received continued maximal medical management (MMM) ($p<0.0001$). Angina results were confirmed by blinded review. Follow up at 12 months was 100%. Event free survival (freedom from death, Q-wave myocardial infarction, and cardiac rehospitalization) was significantly higher (74% versus 37%) in patients randomized to TMR ($p<0.0001$). Exercise tolerance (5.0 METS versus 3.4 METS, $p=0.02$) and quality of life indices (21 versus 12, $p=0.003$) were significantly improved in the TMR group compared to the MMM group. At 12 months the mortality rates (14.8% versus 13.3%), mean change in ejection fraction (0.2% versus −1.3%), and thallium analysis of reversible and fixed defects were not different. This data supports the conclusion that in a prospective, randomized, multicenter trial, patients treated with TMR had significant improvement in angina class, event free survival, exercise tolerance, and quality of life compared to patients treated with continued medical therapy.

167*

QUANTITATIVE AND QUALITATIVE EVALUATION OF SKIN LASER

L. Reinisch*, J.A. Muccini§, Jr., T. Fuller‡ and F.E. O'Donnell, Jr.§

**Department of Otolaryngology, Vanderbilt University Medical Center, Nashville, TN*

§O'Donnell Laser Institute, St. Louis, MO

‡Fuller Research Corporation, Rydal PA

Background and Objectives: A cutaneous laser treatment that spares the epithelium is being developed for the market by BioLase Technologies, Inc. This technology uses a diode laser delivered through and optical fiber to a proprietary handpiece. The laser light is focussed below the skin surface with the handpiece. ***Study Design/Materials and Methods:*** We have investigated the efficacy of this laser system using in vitro skin samples (human breast and facial skin). Tissue contraction and histological evaluation of the skin samples have been performed. Clinical evaluation has also been conducted using photographic techniques. ***Results:*** The Skin Laser treated skin samples show a contraction similar to being resurfaced with the carbon dioxide laser. The Skin Laser treated samples also demonstrate sub-epithelial collagen denaturation while preserving the epithelial layer of the skin. Clinically, patients experience a reduction in the medium and fine wrinkles in our studies. ***Conclusions:*** The Skin Laser appears to be a promising new tool for the treatment of wrinkles.

168

NEW DEVICE DEVELOPMENT: RIDING THE MEDICAL LASER MARKET ROLLER COASTER

Stephen M. Fry

Strategic Business Development, Inc., Hanalei, Hawaii

The medical laser market has undergone many ups and downs over the past decade - through the podiatry era, the laparoscopic cholecystectomy era, the BPH era, and the aesthetic/dermatology era. Specialty applications, such as laser lithotripsy, laser angioplasty, laser refractive surgery and, most recently, laser TMR have also gone through phases of exploration, intense interest, and then either market rejection, or - in the case of market acceptance, rapid saturation. Once a new high volume procedure is identified, a large number of medical laser competitors often jump into the fray, developing alternative approaches or in some cases producing slightly-modified copies of the original technology. In some cases, technologies are commercialized prior to the science being understood and the technologies/products being optimized. Key strategies for success include proactive development of new laser procedures and technologies; leveraging off 'platform technologies'; ensuring that the science and technology development is complete prior to commercialization of the product; and becoming procedure/specialty-oriented. While focus on specific 'hot' market segments is unavoidable, forward-looking new device development should recognize the limitations of equipment sales into each segment, as well as potential competition from non-laser alternative technologies. Development of disposables, adjunctive devices and pharmaceuticals, and other approaches to recurring sales within a given market segment which leverage the installed base of equipment, is essential for continued success – both in terms of revenue and profitability. Case examples, and specific strategies for success will be provided in the oral presentation.

NURSING/ ALLIED HEALTH

172*

THE HAZARDS OF PHOTIC STIMULATION BY VISIBLE PULSED LIGHT SOURCES

Judy A. Chamberlain
Cincinnati, Ohio

Laser protective eye wear is designed to provide adequate protection of the eye from the specific damaging wavelength of each laser. The sensation of light however, may continue to be visible. The ability of pulsed light to induce seizure activity in humans and animals has been well documented. A potential thus exists for rapidly pulsing lasers, within the visible wave ranges, to generate seizure activity in some patients of health care professionals. This paper will provide literature review regarding visible light stimulation and pulse sequences as related to the induction of seizure activity. Additionally, the author will identify pulse rates at which children and adults are most susceptible, and how those pulse rates may sometimes be used in laser therapy. Additional visible, pulsed light sources will be discussed, followed by identification of the most appropriate nursing interventions to alleviate potential hazards to patients and health care personnel.

173*

THE USE OF INTENSE PULSED LIGHT FOR THE TREATMENT OF NEVUS SPILUS

TD Foster, MW Bell, MH Gold
Gold Skin Care Center, Nashville, TN

Nevus spilus is a very difficult clinical lesion, which is macular pigmentation in a segmental distribution, which may or may not be associated with malignant melanoma. A young female presented to our office with nevus spilus on the face and had not gone without makeup in public life since her early childhood years. Using an intense pulsed light source, we were successfully able to clear the nevus spilus. The parameters used and clinical observations noted will be presented in this discussion. The benefits and risks of the procedure will be reviewed in detail. Nevus spilus remains a difficult clinical entity to treat. The intense pulsed light source is a successful modality and should be considered when confronted with nevus spilus.

174

A NURSES GUIDE TO MANAGING THE LASER RESURFACING PATIENT

O'Keeffe M, Kauvar ANB, Geronemus, RG
Laser & Skin Surgery Center of New York

Appropriate preoperative and postoperative care is essential for excellent clinical outcomes following skin resurfacing with carbon dioxide and erbium:YAG lasers. The purpose of this presentation is to educate nurses about proper preoperative preparation, postoperative treatment and wound care following laser skin resurfacing. Guidelines for the management of patients undergoing resurfacing for a variety of indications including wrinkles, photodamage, scars and benign adnexal tumors are presented. Special consideration is given to the early recognition and treatment of infection and complications following laser resurfacing procedures.

175*

TREATING LIGHT HAIRS WITH THE INTENSE PULSED LIGHT SOURCE

SL Street, TD Foster, MW Bell, MH Gold
Gold Skin Care Center, Nashville, TN

Using an intense pulsed light source for long-term epilation, we have successfully developed parameters and techniques to successfully treat light hairs. The current laser systems on the market are specific for the treatment of dark hairs on light skin. Utilizing the intense pulsed light source, however, it is possible to treat light hairs. This will be reviewed during this discussion. Nurses and electrologists are taking leadership roles in treating patients and clients for excess hair and must be aware of the new gains that we have learned with the technologies.